

In re Patent Application of:

VAIL ET AL.

Serial No. **09/991,559**

Filing Date: **NOVEMBER 9, 2001**

REMARKS

The Examiner is thanked for the thorough examination of the present application. Independent Claims 1, 19, and 33 have been amended to include the subject matter of their respective dependent Claims 45, 46, and 47. The specification has been amended to more clearly delineate the description therein of the capacitance variation determination feature formerly recited in Claims 45-47, as helpfully noted by the Examiner. Moreover, Claim 1 has also been amended to correct the noted informality, and Claims 1 and 33 have also been amended to correct a few minor inadvertent errors. No new matter is being added.

In view of the arguments presented in detail below, it is submitted that all of the claims are patentable.

I. The Claimed Invention

The present invention is directed to a temperature sensor. As recited in amended independent Claim 1, for example, the temperature sensor includes a capacitor, a circuit element coupled in series with the capacitor and having a resistance that varies with temperature, and a plurality of calibration resistors coupled to the capacitor and having different resistance values. The temperature sensor also includes a controller for sequentially charging the capacitor through the circuit element and each of the calibration resistors. The controller is also for measuring respective charging times required to charge the capacitor to the predetermined threshold through the circuit element and the calibration resistors, and cooperating with the

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plurality of calibration resistors to determine a capacitance variation of the capacitor. The controller determines the temperature based upon the charging times and the capacitance variation. Accordingly, the temperature sensor not only provides a high degree of accuracy, but it is also easy to calibrate.

Amended independent Claim 19 is directed to a similar temperature sensor, and amended independent Claim 33 is directed to a related method. Each of these claims has been amended similar to Claim 1 to recite that a capacitance variation of the capacitor is determined, and that the temperature is determined based upon the measured charging times and the capacitance variation.

II. The Claims Are Patentable

A. Levine et. al Fails to Teach Determining Capacitance Variation, or Determining Temperature Based Thereon

The Examiner rejected independent Claims 1, 19 and 33, as well as their respective dependent Claim 45-47, based upon Levine et al. (U.S. Patent No. 4,841,458) in view of Lobban (U.S. Patent No. 6,612,737). As noted above, the subject matter of Claims 45-47 has respectively been incorporated into Claims 1, 19, and 33.

Levine et al. is directed to a method for forming a digital signal representing an environmental condition, such as temperature. The method includes measuring the variable time constant of an analog sensing device having a variable resistance

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dependent upon the environmental condition and a capacitor, as well as measuring the reference time constant of a precision fixed resistor and the same capacitor. The time constants are measured by discharging the capacitor, charging the capacitor through the appropriate element, and measuring the time for the voltage across the capacitor to reach a predetermined level. Lastly, the digital ratio between the two time constants is formed. This digital ratio is the digital representation of the temperature by the analog sensing device. See, e.g., abstract of Levine et al.

The Examiner apparently contends that Levine et al. teaches determining a capacitance variation of the capacitor thereof, as well as determining the temperature based upon the measured charging times and the capacitance variation. Yet, the only support the Examiner provides for this contention is that, with respect to Levine et al., "[i]t is inherent, that the charging time (time constant), is a function of the capacitance (capacitance variation) of the capacitor, and thus, temperature." Final Office Action, page 3.

It is respectfully submitted that the Examiner misconstrues Levine et al., as it does not teach or fairly suggest determining a capacitance variation of the capacitor and then determining the temperature based upon measured charging times and the capacitance variation. Rather, Levine et al. uses a completely different approach for addressing capacitance variation. That is, instead of determining the capacitance variation and using this variation in the temperature

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determination, Levine et al. includes a potentiometer for which a set point is determined to "reduce the measurement error due to variable parameters." Col. 7, lines 51-52. More particularly, Levine et al. states that "[i]n the case of the measurement of the set point of the potentiometer, the same capacitor **220** is employed, thereby eliminating any variability in the nominal value of the capacitor." Col. 7, lines 53-56.

Accordingly, the Levine et al. device never attempts to determine what the capacitance variation actually is, but instead simply adjusts the set point of the potentiometer to essentially cancel out any variation. Accordingly, since the capacitance variation is never determined, it cannot be used in the determination of the temperature, as recited in the above-noted independent claims. As such, Levine et al. simply fails to teach or fairly suggest all of the features recited in these claims. To the contrary, Levin et al. teaches away from doing so, as it proposes a completely different arrangement to address this problem.

Since the remaining prior art of records similarly fails to supply this noted deficiency, the rejection of these claims should be withdrawn. To find otherwise would require the impermissible use of the claimed invention in hindsight as a template or road map to piece together the teachings of the prior art.

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B. The Proposed Combination of Levine et. al and Lobban is
Improper

The Examiner correctly acknowledges that Levine et al. fails to teach the use of a plurality of calibration resistors each having different values. Nonetheless, the Examiner contends that Lobban provides this noted deficiency. Lobban is directed to a self-calibrating temperature sensor which includes a controller, a multiplexer having a low on-resistance, two or more calibration reference resistors, and a current-to-frequency converter that performs self-calibrated temperature sensing with temperature sensing devices such as resistance temperature detectors (RTDs). In general, the system performs self-calibrated temperature sensing by using the current-to-frequency converter to provide a constant voltage sequentially to the calibration resistors and one or more RTDs using switches having low on-resistance in the multiplexer, which is controlled by the controller.

The value of one of the reference resistors is correlated to the resistive value of the RTD at the minimum temperature of the operating temperature range for equipment to be monitored, and the value of another reference resistor is correlated to the resistive value of the RTD at the maximum temperature of the operating temperature range for the processing equipment. The values of additional reference resistors, if included, correlate to the resistive values of the RTD at selected intermediate temperatures within the temperature range for the processing equipment. The frequency output by the

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current-to-frequency converter varies directly with current variation, and thus inversely with the resistance of the individual calibration resistor or RTD. The controller determines composite resistance for the calibration resistors and RTDs from the frequencies output by the current-to-frequency converter. A calculation is performed using these resistances to determine temperature values for the RTDs and the equipment with which they are associated. See, e.g., abstract of Lobban.

It is respectfully submitted that the rejection of independent Claims 1, 19 and 33 is in error, as this rejection constitutes improper hindsight reconstruction of the prior art based upon the claimed invention. As discussed in Applicants' Amendment After Final filed December 11, 2003, to establish a prima facie case of obviousness, there must be some suggestion or motivation provided by the prior art for making a proposed combination of references. Moreover, the references must be considered in their entirety, including portions that teach away from the claimed invention.

In this regard, Lobban teaches using a current-to-frequency converter for applying a voltage to different calibration resistors, and calculating temperature based upon the frequencies output by the current-to-frequency converter (which vary with current, or inversely with the resistance of the calibration resistors). The reason that two calibration resistors are used in the Lobban device is to correlate the minimum and maximum values of the operating temperature range for the equipment being monitored.

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In stark contrast, Levine et al. is directed to a temperature sensing device which determines temperature based upon charging times for charging a capacitor through a variable temperature dependent resistance and a precision fixed resistor. Nowhere does Lobban (nor any of the remaining prior art of record) teach or fairly suggest that the calibration resistors thereof may be used in a temperature sensing device that operates using a completely different principle, i.e., based upon measured charging times.

Rather, the fact that Lobban teaches using calibration resistors for a completely different temperature sensing approach (i.e., using current-to-frequency conversion) would have lead those of skill in the art away from haphazardly adding such resistors to the Levine et al. device. Because it operates on a different principle, the Levine et al. device requires no operational range delineation, as does the Lobban device. Thus, selectively adding such operational range correlation resistors to the Levine et al. device would serve no purpose to one of ordinary skill in the art based upon the teachings of these references, so he would therefore have been discouraged from doing so.

In the above-noted Advisory Action, the Examiner acknowledges that "the test for combining references is what the combination of disclosures taken as a whole would suggest" to one of ordinary skill in the art. Advisory Action, page 2 (emphasis added). Yet, the Examiner states in the very same paragraph that the above-noted arguments were not found to be persuasive because

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"the Examiner uses Lobban as a secondary reference, only for its teaching that a plurality of calibration resistors can be used so as to use the device at different measurement ranges." Id.

(emphasis added). Therefore, the Examiner appears to irreconcilably state that he understands that the teachings of Lobban must be considered as a whole, but that he nonetheless is only considering the limited portion of Lobban that supports his rejection.

For the reasons set forth above, it is respectfully submitted that when all of the teachings of Levine et al. and the remaining prior art of record are considered as a whole, there is simply no proper motivation or suggestion provided therein for combining the references as suggested by the Examiner. To the contrary, these references teach away from such a combination. Here again, a contrary finding would require the impermissible use of the claimed invention in hindsight as a template or roadmap to piece together the teachings of the prior art.

Accordingly, it is submitted that independent Claims 1, 19, and 33 are patentable over the prior art. Their respective dependent claims, which recite yet further distinguishing features, are also patentable over the prior art and require no further discussion herein.

CONCLUSIONS

In view of the foregoing, it is submitted that all of the claims are patentable. Accordingly, a Notice of Allowance is respectfully requested in due course. Should any minor

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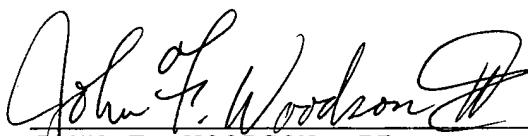
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informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,



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